EFFECT OF DIETARY DIVERSITY ON NUTRITIONAL STATUS AND ACADEMIC PERFORMANCE OF GULU UNIVERSITY STUDENTS

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A REPORT SUBMITTED TO THE FACULTY OF AGRICULTURE AND ENVIRONMENT IN PARTIAL FULFILMENT OF REQUIREMENT FOR THE AWARD OF DEGREE IN BACHELOR OF SCIENCE IN FOOD BIOSCIENCE AND AGRIBUSINESS

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Declaration

I **Adyera Simon Peter**, declare that the content of this work is my own and has not been presented to any university or institution of higher learning for any academic award.

Adyera Simon Peter

Sign…….

Approval

This Report has been submitted with my approval as supervisor:

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Dedication

I dedicate this work to my lovely mother, Mrs. Lanyero Okello Esther, for her passionate care, love, support and guidance throughout my life.

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List of Abbreviations and acronyms

BMI	Body Mass Index
DDS	Dietary Diversity Score
FAO	Food and Agriculture Organization
FFS	Food Frequency Score
FANTA	Food and Nutrition Technical Assistance
GPA	Grade Point Average
MUAC	Mid Upper Harm Circumference
NCDs	None-Communicable Diseases
SD	Standard Deviation
SPSS	Statical Package for the Social Sciences
UGX	Uganda Shilling (Currency)
WHO	World Health Organization

Abstract

This study assessed the effect of dietary diversity on the nutritional status and academic performance of Gulu University students. Poor dietary diversity (DD) among university students can have far-reaching consequences on their academic performance and overall well-being, manifesting in the short, medium, and long term. A cross-sectional descriptive design was used to collect data from 120 undergraduate students through structured questionnaires. Anthropometric measurements, and academic performance records were collected. The average Dietary Diversity Score (DDS) of students was 5.84 ± 2.04, indicating moderate dietary diversity, while the Food Frequency Score (FFS) averaged 9.61 ± 1.65. Most students (73.3%) had normal Body Mass Index (BMI), with a mean BMI of 22.45 ± 3.23, though 6.7% were underweight and 3.3% were obese. Mid-Upper Arm Circumference (MUAC) results revealed that 92.5% were within the normal range. Binary logistics regression analysis showed that dietary diversity was a marginal predictor of academic grades (B = 0.471, p = 0.025), suggesting a positive link between diet quality and cognitive function. Alertness during lectures (B = 1.125, p = 0.007) and activeness in class (B = 1.038, p = 0.023) significantly predicted better academic performance. However, nutrition training, food autonomy, and food frequency did not significantly influence grades. Body Mass Index (BMI) and Mid-Upper Arm Circumference (MUAC) were not significantly influenced by dietary diversity, or sex. Surprisingly, marginally, monthly upkeep significantly and negatively predicted students' grade (B = –0.874, p = 0.094). However, marital status (B = 2.089, p = 0.094) and street food consumption (B = 1.015, p = 0.095) showed marginal associations with MUAC. These findings highlight the complex relationship between students' dietary behaviors, health status, and learning outcomes, underscoring the need for integrated nutrition and academic support programs within university environments.

Key words: Dietary diversity, nutritional status, academic performance, university students, BMI, MUAC, cognitive function

CHAPTER ONE: INTRODUCTION

1.1 Background

Dietary diversity refers to the variety of food groups consumed over a specific period, typically 24 hours. It serves as a proxy for nutrient adequacy, indicating the likelihood that an individual's diet meets their nutritional requirements (Dello Russo et al., 2023). The Food and Agriculture Organization (FAO) defines it as the number of different food groups consumed, rather than individual food items (FAO, 2010). A higher dietary diversity score (DDS) is associated with better micronutrient intake and overall diet quality (Kennedy et al., 2009). A diverse diet ensures the intake of essential nutrients necessary for maintaining good health. Studies have shown that individuals with higher dietary diversity are less likely to experience undernutrition. Adequate nutrition, facilitated by dietary diversity, is crucial for brain development and function. Nutrients such as iron, zinc, iodine, and vitamins A, B6, B12, and D play significant roles in neurodevelopmental processes like neurogenesis, myelination, and neurotransmitter synthesis (Mahapatra & Das, 2023). The first 1,000 days of life are critical for brain development. Nutrition during this period has lasting effects on cognitive abilities. Deficiencies in essential nutrients can lead to irreversible developmental issues (Karavida et al., 2019). Adolescents experience rapid growth and increased nutritional needs. Inadequate dietary diversity during this stage can result in nutrient deficiencies, affecting both physical development and cognitive functioning thus, academic performance (Hargreaves et al., 2022; Norris et al., 2022). In adults, dietary diversity contributes to the prevention of chronic diseases and supports cognitive function. For the elderly, maintaining dietary diversity is vital to prevent cognitive decline and support overall health. Consuming a variety of nutrient-rich foods can help mitigate age-related health issues and maintain quality of life (Liu et al., 2022; Puri et al., 2023).

University students are particularly vulnerable to poor dietary diversity due to a combination of socio-economic, environmental, psychological, and institutional factors. The transition from home to independent living often leads to changes in dietary behavior, as many students lack the necessary cooking skills, nutritional knowledge, and experience in meal planning. This can result in dependence on convenience foods that are energy-dense but nutrient-poor (Martinez-Lacoba et al., 2018b).

In Sub-Saharan Africa, the situation is even more concerning. Many university students in the region experience food insecurity, which limits their access to a variety of foods. A study conducted in South Africa reported that more than 60% of university students faced some level of food insecurity, leading to poor meal patterns, frequent meal skipping, and consumption of low-quality, energy-dense foods (van den Berg & Raubenheimer, 2015). This has serious implications not just for their nutritional status but also for their academic performance. Poor nutrition can lead to micronutrient deficiencies, fatigue, and reduced cognitive abilities all of which interfere with learning and academic success (Puri et al., 2023).

Moving to East Africa, many university students struggle with both the quantity and quality of food intake. In Kenya, for instance, a study at Kenyatta University revealed that only 17% of students met the minimum dietary diversity score, and many depended on two or fewer food groups daily (Korir et al., 2023). Students frequently reported skipping breakfast due to lack of time or money, while others relied heavily on high calorie, low-nutrient street foods. These behaviors are worsened by urbanization, lifestyle changes, peer influence, and academic stress. Additionally, many East African universities lack nutrition support systems or meal programs to address these challenges.

In Uganda, the problem is not very different. Despite being an agricultural country, many students at higher institutions of learning do not meet recommended dietary practices. Studies conducted among university students in Kampala and surrounding areas indicate that meal skipping, especially breakfast, is very common, and that dietary diversity is generally low (Brodin, 2020).

Poor dietary diversity (DD) among university students can have far-reaching consequences on their academic performance and overall well-being, manifesting in the short, medium, and long term. In the short term, inadequate dietary diversity leads to insufficient intake of essential nutrients such as iron, iodine, zinc, and B-vitamins, which are vital for cognitive function, concentration, memory, and energy levels. As a result, students may experience fatigue, reduced attention span, and poor class participation, directly impairing learning and academic output (Puri et al., 2023). Prolonged poor dietary diversity can result in compromised immune function, increased susceptibility to illness, and frequent absenteeism from classes. Nutrient deficiencies such as iron-deficiency anemia or vitamin D deficiency can impair mood and motivation, causing increased stress, anxiety, and even depressive symptoms, which further reduce academic

engagement and performance. Additionally, undernourishment can slow down cognitive development and reduce problem-solving and decision-making skills, all of which are essential for successful academic progression (Puri et al., 2023). Persistent poor dietary diversity can lead to chronic health conditions such as obesity, diabetes, cardiovascular diseases, and long-standing mental health issues. These conditions can limit students' ability to complete their studies or pursue career goals effectively. Furthermore, long-term cognitive impairments associated with chronic undernutrition can reduce lifetime earning potential and productivity. Research also suggests that dietary patterns established during university years often persist into adulthood, meaning poor DD during this critical phase may set the stage for lifelong unhealthy habits (De Oliveira Otto et al., 2015).

The study sought to identify nutritional gaps and their direct and indirect effects on students' cognitive abilities, concentration, memory, class attendance, and academic outcomes, by understanding the effect of dietary diversity on nutritional status and academic performance of Gulu University students.

1.2 Problem Statement

University students often face many challenges that affect how and what they eat. With busy schedules, limited financial support, and the shift to independent living, many students develop poor eating habits such as skipping meals, eating the same foods repeatedly, or depending on cheap, fast foods (Kumar et al., 2020). These behaviors can lead to low dietary diversity and irregular meal patterns, which are known risk factors for poor health outcomes (Mgetta & Muhimbula, 2024).

Good nutrition is essential for both body health and brain function. When students do not eat a variety of foods or regularly skip meals, they may lack important nutrients needed for energy, concentration, and memory. Poor nutrition may result in tiredness, frequent illness, and difficulty concentrating, which can affect academic performance (Musinguzi et al., 2024).

At Gulu University, there is limited research on students' dietary habits, their nutritional status, and how these affect academic performance. Without clear data, it is difficult to plan useful interventions to support student health and learning. This study aimed to assess the dietary diversity of students at Gulu University, and how these factors influence their nutritional status and academic success.

1.3 Objectives of the study

1.3.1 General Objective

To assess the impacts of dietary diversity on nutritional status and academic performance of Gulu University students.

1.3.2 Specific Objectives

1) To assess the dietary diversity scores among students at Gulu University.
2) To evaluate the nutritional status of the students at Gulu University.
3) To assess the academic performance of students at Gulu University.
4) To examine the relationship between dietary diversity, nutritional status, and academic performance among the students at Gulu University.

1.4 Research questions

1) What are the dietary diversity scores among students at Gulu University?
2) What is the nutritional status of students at Gulu University?
3) What is the academic performance of students at Gulu University?
4) What is the relationship between dietary diversity, nutritional status, and academic performance among students at Gulu University?

1.5 Study Justification

The nutritional status and academic performance of university students are of growing public health and educational concern, especially in low- and middle-income countries like Uganda. University students represent a critical population group transitioning into adulthood, and the dietary habits they form at this stage can influence their long-term health, productivity, and intellectual capacity. Despite this, limited attention has been given to understanding their dietary diversity and meal patterns within the university setting. At Gulu University, many students live independently and are responsible for planning and preparing their own meals. However, financial constraints, limited access to a variety of foods, tight academic schedules, and low nutrition awareness may negatively affect their eating habits. These poor dietary practices can lead to undernutrition or hidden hunger, resulting in fatigue, low immunity, and impaired cognitive function, which in turn affects academic performance.

This study was justified because it has generated valuable data on the food consumption patterns, nutritional status, and academic outcomes of students at Gulu University. The findings can help stakeholders including university administrators, health service providers, and policymakers design evidence-based nutrition and academic support interventions. The study can also raise awareness among students about the importance of proper nutrition in supporting academic success and overall well-being.

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

Dietary diversity and meal pattern are key factors influencing students' nutritional status and academic performance. This chapter explores the various studies conducted by other scholars related to the study objectives while identifying gaps necessary at Gulu University setting.

2.1 Dietary diversity among students

The Food and Agriculture organization defines dietary diversity as a measure of the number of individual foods or food groups consumed in a given period of time. Dietary diversity is a qualitative measure of food consumption that reflects household access to a variety of foods (Senanayake et al., 2025). It is the number of foods or food groups consumed over a given reference period.

Food diversity has long been recognized as a key element of high-quality diet, based on the principle that no single food can provide the right amount of nutrients necessary to maintain optimal health (Herrick & Lerman, 2024). It is used as a proxy for nutrient adequacy of the diet of individuals. Dietary diversity is measured at both the household and individual levels by assessing the variety of different food groups consumed in a specific recall period.

Unhealthy dietary habits are common among university students and are associated with increased incidence of lifestyle and chronic illnesses. Poor dietary habits are widely observed among university students, and they are strongly linked to a growing incidence of lifestyle-related illnesses such as hypertension, diabetes, and obesity. During the transition from secondary school to university, students encounter increased independence, academic pressure, and disrupted routines that often lead to poor nutritional behaviors (Martinez-Lacoba et al., 2018b). At this stage, many begin living away from parental guidance and make autonomous decisions about food, which may include skipping meals, irregular eating patterns, and a high intake of energy-dense, nutrient-poor foods. For example, Tok et al. (2018) reported that nearly one-third (33.3%) of university students consumed fewer than three meals a day, a pattern that fails to meet minimum daily dietary requirements. This period of emerging adulthood therefore presents both a vulnerability and an opportunity for targeted nutritional interventions.

In addition to irregular meal consumption, evidence suggests that dietary diversity a key indicator of nutrient adequacy is often suboptimal among university students. Findings from Khulna University in Bangladesh showed that only 55.8% of students achieved minimum dietary diversity, while the remaining 44.2% scored poorly (Mymuna et al., 2024). Factors influencing dietary variety included age, academic level, and urban background. Older students, particularly those in advanced academic years or postgraduate studies, tended to have more diverse diets. However, even among students who managed to consume three main meals daily, food quality and choice were highly variable, often shaped by availability and convenience. Snacking habits ranging from fast foods to chocolates, biscuits, and fruits further showed the inconsistency in dietary practices. Alarmingly, 33% of the students reported skipping breakfast within the previous 24 hours, and nearly half (47.1%) chose food based on immediate availability rather than nutritional value, pointing to reactive rather than planned eating behaviors (López-Gil, Cisneros-Vásquez, et al., 2025).

There is increasing evidence that diet quality not just quantity influences not only physical health but also cognitive performance. Systematic reviews have demonstrated small to moderate positive links between regular consumption of fruits, vegetables, and balanced meals (especially breakfast) and academic achievement in university students (Burrows et al., 2017). In addition, studies report that adolescents with higher intake of ultra-processed foods perform worse academically compared to their peers. Notably, even in younger cohorts, better breakfast quality correlates with improved motivation and test scores (Martin et al., 2024).

Together, these findings emphasize that universities can and should play a vital role in fostering healthier food environments not only to reduce long-term disease risk but also to support academic success and student wellbeing.

Despite increasing literature documenting these patterns, much of the existing research lacks contextual specificity and rarely addresses the relationship between dietary diversity, meal patterns, nutritional status, and academic performance in depth especially within local university settings like Gulu University. Most studies generalize across diverse student populations without accounting for socioeconomic, cultural, and environmental factors that shape student diets, particularly among those living independently. This indicated a critical gap in understanding how

nutrition affects students holistically, not just from a health perspective but also in terms of cognitive performance, classroom engagement, and academic outcomes.

2.2 Meal pattern and lifestyles

Meal patterns among university students are closely intertwined with their nutritional status and broader health outcomes. The structure, frequency, and quality of meals consumed offer critical insight into student well-being. A growing body of literature emphasizes that the way individuals organize their eating, what foods are consumed, how frequently, and under what circumstances reflects not only personal habits but also the influence of social, economic, and environmental context (Mansoor et al., 2022). At the university level, where young adults are often living independently for the first time, these factors can either support or undermine healthy dietary practices.

Poor meal planning, for instance, has been consistently associated with a decline in diet quality. Many students struggle to meet their daily nutritional needs due to erratic schedules, tight budgets, and limited access to balanced meals. Skipping breakfast, in particular, is a widespread issue, often justified by lack of time or appetite in the morning. However, this habit has been linked to lower overall nutrient intake, increased likelihood of snacking on energy-dense, low-nutrient foods throughout the day, and even cognitive and academic impairments (Nishida et al., 2004). Skipping meals, especially breakfast, interferes with glucose regulation, which is essential for maintaining attention and learning efficiency.

Additionally, students' food choices tend to reflect their living arrangements and social environments. Those who live alone or away from family often experience higher levels of dietary imbalance. For example, students living off-campus or in urban centers frequently rely on fast food and convenience items, leading to high intakes of saturated fat, sugar, and salt, and low intake of fruits, vegetables, and fiber. Moreover, the availability of food outlets near universities often favors ultra-processed foods over fresh or minimally processed options. This dietary landscape fosters reactive eating behaviors decisions driven by hunger and availability rather than planning or nutritional value (Senanayake et al., 2025).

Meal timing and composition are also affected by academic schedules and stress. Long hours of classes, combined with study sessions and extracurricular commitments, often result in students

eating late at night or skipping meals altogether. Such irregular eating can lead to digestive issues, impaired sleep, and metabolic disturbances that increase susceptibility to obesity, hypertension, and insulin resistance over time (Mansoor et al., 2022). Over time, consistent disruptions in meal patterns not only affect physical health but may also compromise concentration, memory, and academic performance aspects that are critically important in higher education environments.

Furthermore, the concept of "hidden hunger" micronutrient deficiencies without visible undernutrition affects over two billion people globally and disproportionately affects young adults, including university students (Siregar, 2022). These deficiencies, particularly of iron, zinc, and vitamin A, can impair cognitive development, weaken immune function, and reduce energy levels, compounding the negative effects of erratic eating. Students may meet their energy needs but fail to meet micronutrient requirements, resulting in fatigue, irritability, and reduced academic output.

Social behavior also plays a role in shaping eating patterns. Peer influence, social eating norms, and exposure to online trends can subtly push students toward adopting unhealthy eating habits, such as frequent snacking, meal skipping, or consumption of “trending” but nutritionally void foods. Even among students who have access to university dining services, meal options tend to favor calorie-rich, low-nutrient foods, reinforcing these behaviors (Fonseca et al., 2021). Recognizing and understanding dietary patterns such as preference for high-sugar breakfasts or processed dinners is essential for tailoring effective, culturally appropriate health promotion strategies within campuses.

Ultimately, while existing studies have documented the prevalence of poor eating habits among university students, very few have explored how these patterns intersect with broader outcomes such as academic performance, stress management, and overall well-being particularly in underrepresented institutions like Gulu University. This gap presented an opportunity to contextualize meal behaviors within the lived experiences of students in developing country settings, where dietary diversity, financial limitations, cultural food preferences, and institutional support all interact in complex ways to shape student health and success.

2.3 Nutritional status of university students

Nutritional status refers to the overall condition of an individual's body as influenced by the intake, absorption, and utilization of nutrients. It is assessed using a combination of indicators such as

anthropometric measurements (BMI, waist-to-hip ratio), biochemical markers, clinical signs, and dietary surveys. For university students, these indicators often reveal significant health concerns stemming from irregular eating habits, limited nutrition knowledge, and challenging campus environments. According to Suchitra et al., (2021), nutritional status is a direct outcome of both the quality and quantity of nutrients consumed and their utilization, which in turn affects energy balance, immune competence, and cognitive function.

Nutritional status is the sum total of an individual's anthropometric indices as influenced by intake and utilization of nutrients, which is determined from information obtained by physical, biochemical and dietary studies. It is a result of interrelated factors influenced by quality and quantity of food consumed and the physical health of an individual (Kumar et al., 2020).

Evidence from various university settings reveals a worrying pattern of malnutrition among students characterized by both undernutrition and overnutrition. For instance, a study among undergraduate medical students in Central India found that 40% of hostel residents were underweight and 6% were overweight, mainly due to increased junk food consumption and reduced dietary fiber intake (Suchitra et al., 2021). These findings reflect broader global trends, where students in independent living situations are more likely to consume energy-dense, nutrient-poor foods due to convenience, limited cooking skills, or food availability (Rudzka et al., 2024; Suchitra et al., 2021).

Micronutrient deficiencies, often referred to as "hidden hunger," also pose a major threat to student health. Despite appearing physically healthy, many students suffer from insufficient intake of essential micronutrients such as iron, zinc, vitamin A, and vitamin D. These deficiencies can impair immune function, cause fatigue, reduce mental alertness, and compromise academic performance. Globally, over two billion people are estimated to suffer from micronutrient deficiencies, with young adults being a particularly affected group (Senanayake et al., 2025). A review by Huda & Ahmad, (2010) found that university students frequently consume monotonous diets low in fruits, vegetables, and legumes contributing to widespread nutrient gaps. Such deficiencies often go unnoticed in BMI-based assessments, highlighting the need for more comprehensive tools.

In West Africa, a study assessing dietary diversity and nutritional status among Nigerian university students found that although most students had normal BMI, up to 26.5% exhibited low dietary diversity scores. Male students showed slightly higher diversity scores than females, but both groups demonstrated limited intake of critical food groups like fruits, vegetables, and animal-based proteins (Akinlua O, 2014). Given the role of dietary diversity in ensuring sufficient micronutrient intake, these findings are alarming and indicate a risk of long-term nutritional inadequacy among university students.

Campus residence and food environment are key determinants of nutritional status. Students who live in hostels or independently tend to face unique challenges such as limited access to kitchen facilities, time constraints, and budget limitations, all of which negatively influence their eating habits. A Malaysian study by Huda & Ahmad, (2010) revealed a significant percentage of underweight students, particularly those living alone, who frequently skipped meals or substituted them with energy-dense snacks. Similar patterns have been observed in African contexts such as Sudan and Uganda, where limited institutional feeding programs and food insecurity further restrict students' access to adequate nutrition (Khan et al., 2015).

Despite the prevalence of nutritional risks, current assessments of student nutrition are often inadequate. Many rely exclusively on BMI without integrating dietary recalls, biochemical tests, or symptom screening, thereby missing important aspects of health. For example, a student may be within a normal BMI range yet suffer from iron-deficiency anemia or low vitamin D levels—conditions that significantly affect energy, cognition, and academic success (Simon et al., 2025). To generate more meaningful data, universities and researchers should adopt multidimensional assessment frameworks that include anthropometric, dietary, biochemical, and behavioral components.

The implications of poor nutrition extend beyond health to learning outcomes. Multiple studies show that students with inadequate nutrient intake are more likely to experience fatigue, reduced concentration, and academic underperformance University administrations must respond by enhancing food environments, nutrition education, and screening efforts. This includes subsidizing healthy food options, providing cooking facilities or shared meal programs, integrating nutrition

modules into academic programs, and promoting regular nutrition monitoring through student health services.

2.4 Academic performance and its link to dietary diversity and nutrition status

The academic performance of children impacts their future educational attainment and health and has therefore emerged as a public health concern. Generally, as levels of education increase, there is an associated increase in income and social status. This associated increase in socioeconomic status affects health by influencing access to health care, quality of housing, work environment, lifestyle factors, such as nutrition and recreation, and social psychological factors, such as self-esteem and health awareness (Florence et al., 2008).

Good nutrition is vital for normal performance of body cells and organs. Proteins are found in foods such as meat, fish, milk, and cheese. They are used to make most of the body's tissues, including neurotransmitters, identified as chemical messengers that carry information from brain cells to other brain cells. A lack of protein, also known as Protein Energy Malnutrition, lead to poor school performance by individuals and causing them to be lethargic, withdrawn, and passive, all of which help affect social and emotional development (Woodhouse, 2012).

Carbohydrates are commonly found in grains, fruits, and vegetables. Carbohydrates are broken down into glucose (sugar) which is where the brain gets its energy. Fluctuating levels of carbohydrates may cause dizziness and mental confusion, both of which can affect cognitive performance. Eating a carbohydrate-heavy meal can cause one to feel more calm and relaxed because of a brain chemical called serotonin and its effect on mood. Serotonin is created within the brain through the absorption and conversion of tryptophan. Tryptophan is absorbed within the blood and this absorption is enhanced with carbohydrates (Erickson, 2006). Additionally, Omega-3 fatty acids are very important to the optimum performance of the brain and a lack of these fats can lead to depression, poor memory, low IQ, learning disabilities, dyslexia, and ADD. Important foods to consume to ensure an Omega-3 fatty acid diet are certain fish and nuts (Erickson, 2006).

Wheeler cite research done by Gomez-Pinilla, a UCLA professor of neurosurgery and physiological science. According to the article, diet, exercise, and sleep have the potential to alter brain health and mental function. Gomez-Pinilla stated that it stands to reason that changes in diet could be used to enhance cognitive abilities. His research has shown that Omega-3 fatty acids such

as those found in salmon, kiwi fruit, and walnuts, provide many benefits in improving memory and learning, much of which occurs at the synapses. Omega-3 fatty acids support synaptic plasticity and seem to positively affect the expression of several molecules related to learning and memory that are found on the synapses. Omega-3 fatty acids are essential for normal brain function. The article states that a deficiency in Omega-3 fatty acids can lead to increased risk of attention-deficit disorder and dyslexia

The World Health Organization (WHO) recommends 55-75% of humans' calories come from carbohydrate; however, the recommendation for carbohydrate intake based on the Dietary Guidelines for Americans, at 45-65%, is slightly lower. Likewise, U.S. dietary guidelines recommend a higher ratio of calories coming from fat (25-35%) and protein (10-30%) than those of the WHO (U.S. Department of Health and Human Services [USDHH] and U.S. Department of Agriculture [USDA], 2005). The minimum carbohydrate intake require for fundamental brain function is 130 grams (roughly 520 calories) per day (Davis & Melina, 2010).

Research shows that children with iron deficiencies sufficient to cause anemia are at a disadvantage academically. Their cognitive performance seems to improve with iron therapy. A similar association and improvement with therapy is found with either zinc or iodine deficiency, according to the reviewed articles. Food insufficiency is a serious problem affecting children's ability to learn. Same research indicates that school breakfast programs seem to improve attendance rate and decrease tardiness (Taras, 2005).

Similarly, the literatures showed little interplay between dietary diversity, meal pattern, nutrition status and academic performance. Additionally, most of the studies are conducted in develop nations and are old data, recent eating habits of university students and the impact of their academic performance are less studied especially in Uganda and at the context of Gulu University. Therefore, tailored research which look at the interplay between dietary diversity and meal pattern with their impact on nutritional status and academic performance of Gulu University students was necessary.

2.5 Summary of the literature

The literature revealed that dietary diversity was essential for achieving nutrient adequacy and promoting both physical and cognitive health. University students often exhibited poor dietary habits due to increased independence, academic pressure, and limited nutritional knowledge,

which led to irregular meals, skipping breakfast, and consumption of energy-dense, low-nutrient foods (López-Gil, Smith, et al., 2025; Mahmud, 2024; Martinez-Lacoba et al., 2018a). Studies also indicated that meal quality and food choices among students were influenced by convenience, availability, and lifestyle factors, all of which affected their nutritional status and academic outcomes (Burrows et al., 2017; Islam et al., 2023; Mgetta & Muhimbula, 2024).

Despite these findings, most of the existing research focused on general student populations in high-income or Asian countries, without considering contextual factors such as culture, income, or institutional support especially in African settings. Few studies examined the interconnectedness of dietary diversity, meal patterns, nutritional status (including hidden hunger), and academic performance in a single framework (Huda & Ahmad, 2010; Senanayake et al., 2025; Suchitra et al., 2023). Most relied on singular metrics like BMI and did not incorporate more comprehensive assessments that combined anthropometric, behavioral, and cognitive indicators.

Therefore, this study addressed a critical gap by exploring how dietary diversity and meal behaviors related to nutritional and academic outcomes among students at Gulu University.

CHAPTER THREE: METHODOLOGY

3.0 Introduction

This chapter explains how the study was conducted right from concepts to the summary, the section indicates the study designed used, sampling techniques, data collection and analysis.

3.1 Study design

The study adopted a cross-sectional descriptive design using quantitative and qualitative methods. The methods were suitable because they allowed for the objective measurement and statistical analysis of key variables, including dietary diversity scores, anthropometric indicators (such as Body Mass Index), and academic performance data (such as GPA and class attendance records) as well as dietary pattern and other academic indicators like class attendance and alertness in class. The design was appropriate for assessing dietary diversity, meal patterns, nutritional status, and academic performance at a single point in time among Gulu University students. Data were collected through structured questionnaires, dietary diversity score questionnaire, anthropometric measurements, and student academic performance questionnaire. The approach allowed the researcher to explore relationships between dietary habits, nutritional outcomes, and academic performance of Gulu University students.

3.2 Study Area

The study was conducted at Gulu University, located in Pece-Laroo division, Gulu city, Northern Uganda. Gulu University is a public institution offering a diverse range of academic programs across various faculties, including Medicine, Agriculture, Science, business and Development, Education and Humanities, and Law. The study was conducted at Gulu University primarily because the researcher resides within the study area, which ensured better logistical access, familiarity with the institutional systems, and ease in coordinating data collection activities. Additionally, being a public university, Gulu University represented the similar dynamic environment experienced in most public university settings within Uganda. The University is located at 2°47’19.0”N, 32º19’01.0”E (Latitude: 2º788620; Longitude: 32º316946).

3.3 Study Population

The study population consisted of undergraduate students enrolled at Gulu University during the study period, Undergraduate students are often living away from home for the first time and are responsible for managing their own meals, usually with limited financial resources. These students were from various faculties and academic years, representing a diverse range of backgrounds, dietary habits, and living conditions. Both residential and non-residential students were included to capture differences in dietary diversity based on living arrangements, as access to food sources could vary.

Participants were selected regardless of gender, socioeconomic status, or academic program, provided they were full-time registered students. That ensured a diverse and representative sample, allowed the study identified broad patterns and avoided bias in assessing how dietary diversity affects nutritional status and academic performance.

3.4 Sample Size Determination

The sample size was determined using the Yamane (1967) formula for a known population:

$$n = \frac{N}{1+Ne^2}$$

where: n = sample size

N = population (5785 estimated student population) (Otim et al., 2024).

e = margin of error (0.10)

$n= 5785/1+5000(0.10)^2$

= 120. Thus, a sample size of 120 students was used, based on a precision level of $\pm$ 10% suitable for the study scope and resources.

3.5 Sampling Techniques

A stratified random sampling technique was employed to ensure representation across different faculties at Gulu University, later on a quota sampling method was used to get students from each faculty. That involved getting data from any student until the specified sample size of the faculty

was met (Yang & Banamah, 2014). Students from every faculty were considered for the study as long as they were willing to participate and were eligible as per the inclusion criteria guided.

The sample size from each faculty was computed as per the relative ratio of number of students in each faculty as shown below.

Total population = 5785

The sample size per faculty = (n/N) ×120

Where n = number of students in the faculty, N = total population

Table 3-1 Sample size distribution of students within faculties

Faculty of study	Number of students	Sample size
Agriculture	700	16
Law	375	15
Science	320	10
Medicine	520	13
Education and Humanities	2200	38
Business and Development studies	1000	19
Peace and strategy studies	70	9

Source: (Otim et al., 2024)

The method enhanced the representativeness of the sample, allowed for easy and unbiasedness during data collection.

3.6 Inclusion and Exclusion criteria

The study included all undergraduate students who registered at Gulu University at the time of data collection. Only students who had completed at least one semester and had available academic records were considered and were willing to participate.

Non-enrolled individuals were excluded to ensure the data strictly represented the target population of active, full-time Gulu University students. Students who had known medical conditions such as chronic illnesses or eating disorders, which affected dietary intake were also excluded. Additionally, those who declined to participate or provided incomplete data, especially regarding academic performance, were not included in the final analysis to ensure reliability and accuracy.

3.7 Data collection methods and tools

Data were collected using a combination of quantitative methods and qualitative methods, included, self-administered questionnaire, dietary diversity questionnaire (DDS), food frequency questionnaires (FFQ), and anthropometric measurements. The following tools will be employed to gather comprehensive data on dietary intake, meal patterns, nutritional status, and academic performance.

3.7.1 Dietary Diversity Score (DDS)

The Dietary Diversity Score (DDS) was calculated based on the variety of food groups consumed during the 24-hour period (Hoddinott & Yohannes, 2002). It involved grouping foods into 12 food groups and assigning a score based on the number of different groups consumed. A higher DDS indicated better dietary diversity (FAO, 2013).

3.7.2 Food Frequency Questionnaire (FFQ)

A Food Frequency Questionnaire was used to assess the frequency of consumption of specific food items over a month. The FFQ allowed for a broader understanding of students' eating habits and provided context for the 24-hour recall (Urval et al., 2014). It included questions on the frequency of consumption of different food items such as fruits, vegetables, meat, dairy, and processed foods. The tool identified long-term dietary patterns and their potential relationship with academic performance.

3.7.3 Anthropometric Measurements

Anthropometric measurements were used to assess participants' nutritional status (Steyn et al., 2006). Multiple measurements, included weight, height, and mid upper arm circumference (MUAC) were taken (FAO, 2013). To calculate Body Mass Index (BMI) , weight of individuals were divided by the square of height (m^2), and the BMI categorized into Under-weight (BMI < 18.5), normal (18.5-24.9), over-weight (25-30) and obese (above 30), (Nishida et al., 2004).

3.7.4 Academic Performance Questionnaires

Secondary data on academic performance grade were obtained from the participants. Additionally, participants filled self-administered Academic performance questionnaires to assess their experience during classes based on meal pattern and type behavior. These grades and experiences were used as a measure of academic performance, and the relationship between dietary patterns, nutritional status, and academic success were analyzed.

3.8 Data quality control

To ensure the accuracy, reliability, and validity of the data collected, several quality control measures were implemented throughout the study:

Training of Data Collectors

All data collectors (research assistants) underwent a comprehensive training session to ensure consistency in administering the questionnaires and performing anthropometric measurements. The training covered proper techniques for conducting 24-hour dietary diversity questionnaire, using the Food Frequency Questionnaire (FFQ), and measuring weight, height, and Mid Upper Arm circumference. In addition, the data collectors were trained on ethical considerations, including maintaining confidentiality and ensuring informed consent.

Pre-Test and Pilot Study

A pre-test of the questionnaire and data collection methods was conducted on a small sample of students to identify any ambiguities or issues with the instruments. This helped refined the tools and ensured they are clear, understandable, and capable of capturing the necessary information accurately.

3.9 Data analysis

Data collected from 120 students were coded, cleaned, and analyzed using SPSS Version 25. Several variables were transformed prior to analysis to fit the appropriate statistical models. Academic performance (originally GPA categories) was reclassified into a binary dependent variable, coded as "1" for good grades (First Class, Second Upper, Second Lower) and "0" for poor grades (Pass and Fail). Food group consumption variables (e.g., cereals, roots, vegetables, fruits,

milk, meat, eggs) were coded as binary indicators based on 24-hour recall: "1" for consumed, "0" for not consumed. Socio-demographic factors such as sex, marital status, residence, and year of study were also converted into dummy variables, while financial-related variables like monthly upkeep remained continuous. Other independent variables like DDS (Dietary Diversity Score) and FFS (Food Frequency Score) were treated as continuous predictors.

Descriptive statistics including means, standard deviations, frequencies, and percentages were computed to summarize socio-demographic characteristics, dietary behavior, nutritional indicators, and academic performance. For inferential analysis, linear regression models were applied to identify predictors of continuous outcomes, Body Mass Index (BMI) and Mid-Upper Arm Circumference (MUAC). Meanwhile, binary logistic regression was used to determine factors influencing academic performance, using the transformed grade categories as the dependent variable. Explanatory variables in the models included dietary diversity, food sourcing behavior, class alertness, participation, and socio-demographic factors. Significant and marginal predictors were interpreted using regression coefficients (B-values) and p-values, at 5% and 10% significance thresholds. This analytic approach allowed the study to identify key dietary and behavioral predictors of students' nutritional and academic outcomes.

Table 3-2 Summary of the variables transformed during analysis

Variable	Definition	Value and Unit of Measurement
Dependent Variables		
Students' grade category	Academic performance category of the student based on GPA	Dummy variable: 1 = Good (First/Second class), 0 = Bad (Pass/Fail)
Cereal consumption	Whether the student consumed any cereal foods (e.g., maize, rice, millet, wheat) in past 24h	Dummy variable: 1 = Yes (Consumed), 0 = No
Root & tuber consumption	Whether the student consumed any root/tuber foods (e.g., cassava, sweet potatoes) in past 24h	Dummy variable: 1 = Yes, 0 = No
Vegetable consumption	Whether the student consumed vegetables (e.g., greens, cabbage, tomatoes) in past 24h	Dummy variable: 1 = Yes, 0 = No
Fruit consumption	Whether the student consumed fruits (e.g., mangoes, oranges, bananas) in past 24h	Dummy variable: 1 = Yes, 0 = No
Meat consumption	Whether the student consumed meat (beef, goat, chicken, pork) in past 24h	Dummy variable: 1 = Yes, 0 = No
Egg consumption	Whether the student consumed eggs in past 24h	Dummy variable: 1 = Yes, 0 = No
Fish & seafood consumption	Whether the student consumed fish or other seafood in past 24h	Dummy variable: 1 = Yes, 0 = No
Milk consumption	Whether the student consumed milk or milk-based products in past 24h	Dummy variable: 1 = Yes, 0 = No
Body Mass Index (BMI)	Weight status measured as weight (kg) divided by height squared (m^2)	Continuous variable (kg/m^2)
Mid-Upper Arm Circumference (MUAC)	Nutritional status using upper arm circumference	Continuous variable (cm)

Table 3.2 Summary of the variables transformed during analysis (continuous)

Variable	Definition	Value and Unit of Measurement
Independent Variables		
Sex	Gender of student	Dummy variable: 0 = Female, 1 = Male
Marital status	Whether student is married or not	Dummy variable: 0 = Not married, 1 = Married
Year of study	Academic year level of the student	Dummy variable: 0 = Year 1 & 2, 1 = Year 3 & above
Residence	Where the student stays during semester	Dummy variable: 0 = Home, 1 = Hostel
Monthly upkeep	Monthly financial support available to student	Continuous variable (Uganda Shillings)
Faculty of study	Faculty of	
Cooking own food frequency	Frequency of cooking meals per week	Dummy variable: 0 = ≤ 3 times/week, 1 = > 3 times/week
Food choice autonomy	Who decides what the student eats	Dummy variable: 1 = Self, 0 = Others
Nutrition training	Whether the student has had training on healthy eating	Dummy variable: 1 = Yes, 0 = No
Food source: Home	Whether food is sourced from home	Dummy variable: 1 = Yes, 0 = No
Food source: Local market	Whether food is sourced from local markets	Dummy variable: 1 = Yes, 0 = No
Food source: Street vendors	Whether food is sourced from street vendors	Dummy variable: 1 = Yes, 0 = No
Food source: Supermarket/Shop	Whether food is sourced from supermarket or shop	Dummy variable: 1 = Yes, 0 = No
Food source: Campus cafeteria	Whether food is sourced from campus cafeteria	Dummy variable: 1 = Yes, 0 = No
Provider of upkeep (Parents)	Whether upkeep is provided by parents	Dummy variable: 1 = Yes, 0 = No
Provider of upkeep (Guardian)	Whether upkeep is provided by guardian	Dummy variable: 1 = Yes, 0 = No
Provider of upkeep (Sponsor)	Whether upkeep is provided by sponsor	Dummy variable: 1 = Yes, 0 = No
Provider of upkeep (Self)	Whether upkeep is self-funded	Dummy variable: 1 = Yes, 0 = No
Having dependents	Whether student has others they support financially	Dummy variable: 1 = Yes, 0 = No
Alertness during lecture	Student's attention during lectures	Dummy variable: 1 = Alert, 0 = Not alert
Activeness in class participation	Student's level of participation in class activities	Dummy variable: 1 = Active, 0 = Rare or not active
Class attendance frequency	How often the student attends classes	Ordinal (may be transformed for regression)
Dietary Diversity Score (DDS)	Number of food groups consumed in past 24 hours (diet quality measure)	Continuous variable (0 to 12)
Food Frequency Score (FFS)	Frequency of consuming various foods in a typical month	Continuous variable
Cost of food	Whether cost of food is a barrier to dietary diversity	Dummy variable: 1 = Barrier, 0 = Not a barrier
Seasonal food variation	Whether food variety changes across seasons	Dummy variable: 1 = Yes, 0 = No

3.10 Ethical consideration

Informed consent was obtained, and participants' confidentiality was maintained. Participation was voluntary, and the study aimed to minimize harm. Additionally, sensitive data were anonymized, and feedback on findings was provided to participants.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.0 Introduction

This chapter presents the results of the study on the effect of dietary diversity on the nutritional status and academic performance of Gulu University students. The findings are organized according to the study objectives and are presented using tables, figures, and summary statistics. A total of 120 students participated in the study.

4.1 Socio-demographic characteristics of students

Socio-demographic characteristics of the 120 students who participated in the study revealed a nearly equal gender distribution, with 50.8% being male and 49.2% female. The majority of the respondents (92.5%) were not married, which was expected given the university setting. In terms of residence, most students stayed in hostels either alone (45.8%) or with roommates (37.5%) while a smaller number lived with their parents (9.2%) or relatives (7.5%) (table 4-1).

The distribution across academic years showed that students in the second year (26.7%) and those in fourth year and above (29.1%) made up the largest groups, while first-year students constituted 19.2%. Monthly upkeep varied, with nearly half of the students (48.3%) receiving between 50,000 and 100,000 UGX, while a few (5.1%) received more than 200,000 UGX. This variation in financial support likely influenced their food choices and dietary diversity (table 4-1).

Most students (91.7%) did not have dependents, which likely reduced economic pressures. Parents were reported as the primary source of upkeep (38.1%), followed by sponsors (24.2%), guardians (20.1%), and self-support (17.6%). These findings suggested that students' financial backgrounds, living arrangements, and academic level might have influenced their nutritional status, dietary practices, and academic performance (table 4-1).

Table 4-1 Socio-demographic characteristics of students

Variable	Category	Frequency (n=120)	Percentage (%)
Sex	Male	61	50.8
	Female	59	49.2
Marital status of students	Not married	111	92.5
	Married	9	7.5
Residence of students	Home with parents	11	9.2
	Home with relative	9	7.5
	Hostel alone	55	45.8
	Hostel with roommate	45	37.5
Year of study	Year one	23	19.2
	Year two	32	26.7
	Third year	30	25
	Fourth year and above	35	29.1
Monthly upkeep	< 50,000/=	34	28.3
	50,000-100,000/=	58	48.3
	100,001-200,000/=	22	18.3
	>200,000/=	6	5.1
Students with dependents	Yes	10	8.3
	No	110	91.7
Provider of upkeep	Parents	74	38.1
	Guardian	39	20.1
	Sponsor	47	24.2
	Self	34	17.6

The age of the students ranged from 19 to 45 years, with a mean age of 24.02 years and a standard deviation of 3.264, indicating that most participants were in their early to mid-twenties, typical of a university population. Among the few students who reported having dependents (n = 10), the number of dependents ranged from 2 to 5, with an average of 3.00 and a standard deviation of 1.155 (table 4-2). This suggested that although only a small portion of students had dependents, those who did tended to support multiple individuals, potentially placing additional financial or emotional strain on them

Table 4-2 Age distribution of students and number of dependents

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Age of Students	120	19	45	24.02	3.264
Number of dependants	10	2	5	3.00	1.155

4.1.1 Students' distribution within faculties

The highest number of students was from faculty of education (31.7%), followed by business (15.8%). The least number came from faculty of peace (7.5%) (figure 4-1).

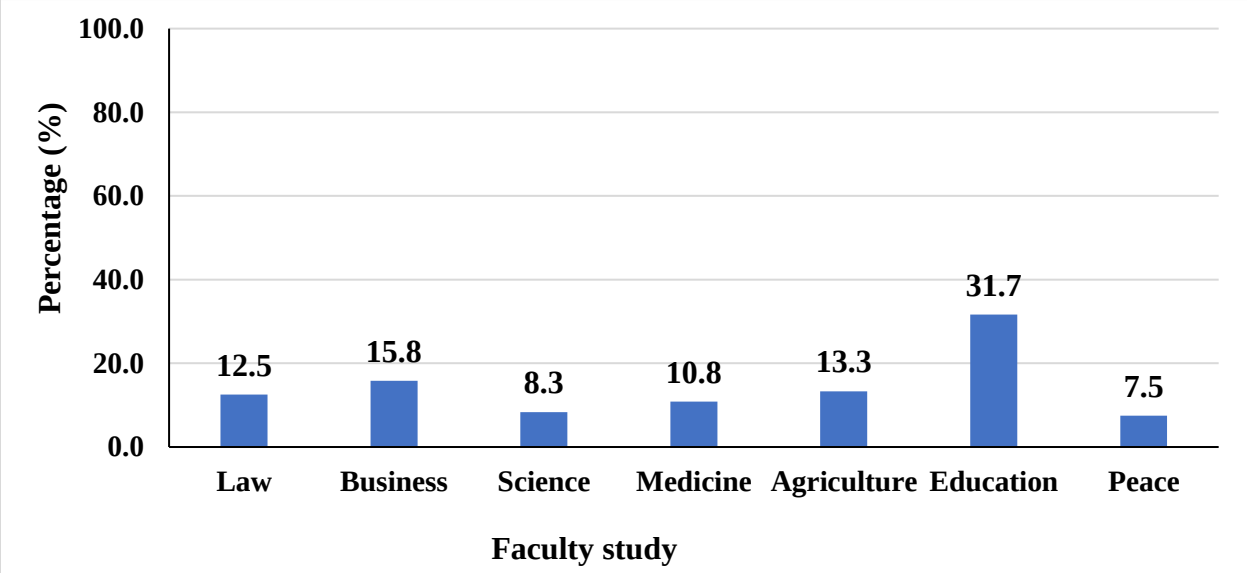

Figure 4-1 Students' distribution within faculties

4.2 Dietary diversity of students

4.2.1 Dietary pattern and behavior

More than half (70.8%) of the students studied at least had training on healthy eating or nutrition. The highest proportion (60.8%) indicated that cost of food is the main barrier to eating variety of food with more than half (99.2%) at least cook their own food within a week. 80% of the students decide their own meal with 75% experience change in variety of food they eat across semester/month. 74.7% of those who experience change in what they eat, had variety at the beginning of the semester and decreases as the semester proceeds. More than half (78.3%) said seasonal changes affect the variety of food they eat (table 4-3).

Table 4-3 Dietary pattern and behavior

Variable	Category	Frequency (n=120)	Percentage (%)
Training on nutrition	Yes	85	70.8
	No	35	29.2
Barrier to eating variety of food	Cost of food	73	60.8
	Limited time	34	28.3
	Limited food availability	9	7.5
	Lack of knowledge	2	1.7
	Peer/culture influence	2	1.7
Frequency of cooking own food	Daily	44	36.7
	3-4 times a week	54	45.0
	1-2 times a week	21	17.5
	Never	1	8
Decision on food eaten	Self	96	80.0
	Roommate	9	7.5
	Family/relative	15	12.5
Experience changes in food variety across the semester	Yes	90	75
	No	30	25
Nature of changes in food variety	Eat more variety at the beginning of semester	68	74.7
	Eat more variety at the beginning of months	20	22.0
	Eat more variety at the end of months	3	3.3
Students whose food choices are affected by seasons	Yes	94	78.3
	No	26	21.7

4.2.2 Students' sources of food and copying strategies during food shortage

The most common source of food among respondents was the local market (95.0% of cases), followed by street vendors (74.2%) and home-grown food (65.0%). Other sources included campus cafeterias (44.2%) and supermarkets or shops (30.0%) (table 4-4).

When faced with limited food availability, students adopted coping strategies, the most frequently reported strategy was buying cheap, less nutritious food (89.2%), followed by visiting friends or relatives (64.2%) and eating carbohydrate-rich foods (63.3%). Skipping meals (57.5%) and borrowing food or money (33.3%) were also noted among the respondent.

Table 4-4 Students' sources of food and copying strategies

Variable	Category	Frequency (n=120)	Percent of cases (%)
Sources of food	Home	78	65.0
	Local market	114	95.0
	Supermarket/shop	36	30.0
	Street venders	89	74.2
	Campus cafeteria	53	44.2
Copying strategy	Skip meals	69	57.5
	Borrow food/money	40	33.3
	Buy cheap, less nutritious	107	89.2
	Eat carbohydrate-rich food	76	63.3
	Visit friends or relative	77	64.2

4.2.1 Factors that influence the consumption of different food groups

The analysis identified several socio-economic and demographic factors associated with the consumption of specific food groups among students (table 4-5). Notably, monthly upkeep had a strong positive association with vegetables consumption (B = 2.417**), indicating that students with higher financial support were more likely to consume vegetables. Year of study also positively and marginally influenced the consumption of cereals, students in higher level was associated with the consumption of more cereals than the beginners. Having dependents also positively influenced vegetables consumption (B = 4.081**), suggesting that responsibility for others may lead to better food variety in the household.

Sex of students was significantly associated with egg consumption (B = -1.007**) and meat (-0.992**), with males possibly not consuming more eggs and meat than females. Likewise, faculty of study (science) and residence (hostel) showed marginal association with fish consumption (B = 0.914*) and (B = 1.488*), implying that hostel students and those from science faculties (Medicine and agriculture) may have better access to those food. No other factors such as nutrition training, food choice, or age showed significant or marginal effects on the consumption of cereals, roots and tubers, vegetables, or meat in this model.

Table 4-5 Factors that influence the consumption of various food groups

Factor	Cereals	Roots & tubers	Vegetables	Fruit	Meat	Eggs	Fish & sea food	Milk
Sex of Students (Male)	0.677	0.191	0.167	0.114	-0.992**	-1.007**	0.659	-0.50
Marital status (Married)	0.559	0.845	1.756	-0.093	-0.656	0.76	0.234	0.316
Year of study	0.88*	-0.028	0.285	0.141	0.35	-0.237	0.495	0.216
Faculty (Science)	0.265	0.484	0.479	0.212	0.203	-0.274	0.914*	-0.31
Resident (Hostel)	1.039	0.036	-1.228	-0.158	-1.212	-0.239	1.488*	-0.24
Monthly upkeep	0.799	0.541	2.417**	0.056	0.052	0.259	0.463	.184
Frequency of cooking own food	-0.763	0.409	-0.911	-0.648	-0.594	-0.006	1.048	-0.87
Food choice autonomy (Self)	-0.586	-0.256	-0.774	-0.168	-0.209	0.225	-0.508	-0.49
Having dependent	-19.735	0.29	4.081**	-0.842	0.659	1.149	-2.315	-0.99
Nutrition training	-0.39	0.329	-0.117	-0.044	-0.132	-0.271	0.296	0.218
Seasonal variation	0.062	0.069	0.052	0.654	0.555	0.399	–0.397	0.122
Constant	0.576	-1.892	-3.43**	0.425	0.597	-1.906	-3.001*	0.442

Key: The stars on the values indicate the level of significant. * Means 10% significant, ** indicates 5% significant

4.2.2 Dietary diversity score and food frequency score of students

The Food Frequency Score ranges from a minimum of 2 to a maximum of 12, with a mean value of 9.61 and a standard deviation of 1.646, indicating relatively frequent consumption of different food types with moderate variability (table 4-6). The Dietary Diversity Score ranges from 1 to 11, with a mean of 5.84 and a standard deviation of 2.042, suggesting that students, on average, consume around six food groups, though there is a wide variation in dietary diversity among them (table 4-6).

Table 4-6 Dietary diversity score and food frequency score

Variable	Minimum	Maximum	Mean	Std. Deviation
FFS	2	12	9.61	1.646
DDS	1	11	5.84	2.042

4.3 Nutrition status of students

4.3.1 Anthropometric results

Table 4-7, students' anthropometric indicators varied across the sample. Heights ranged from 1.55 to 1.85 meters with a mean of 1.69 ± 0.068 m. Body weights ranged from 46.30 kg to 97.20 kg, averaging 64.04 ± 10.51 kg. Mid-upper arm circumference (MUAC) measurements had a mean of 27.05 ± 2.44 cm, with values between 21.0 cm and 35.9 cm. The Body Mass Index (BMI) values ranged from 16.8 to 31.4, with a mean BMI of 22.45 ± 3.23.

Table 4-7 Anthropometric measures of students

Variable	Minimum	Maximum	Mean	SD
Height	1.55	1.85	1.6885	.06810
Weight	46.30	97.20	64.0375	10.50953
MUAC	21.0	35.9	27.047	2.4376
BMI	16.8	31.4	22.445	3.2269

4.3.2 Students' nutrition status

Most students (73.3%) had their Body Mass Index (BMI) within the normal, 6.7% were underweight. 20 % were above the normal weight, with 3,3% of that had their BMI within the obese rage (figure 4-2).

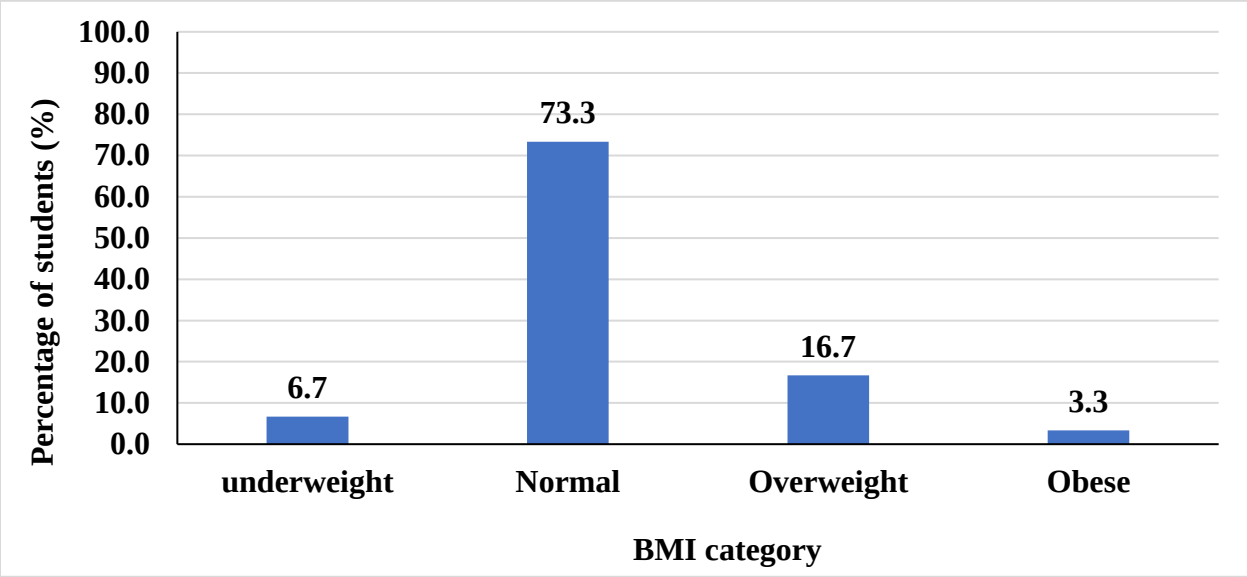

Figure 4-2 Students' BMI category

Figure 4-3 the Mid Upper Arm Circumference of students indicated majority (92.5%) within the normal rage. Very few (2.5%) were within the range of undernourishment, a small proportion (4.2%) also were above the normal range (figure 4-3).

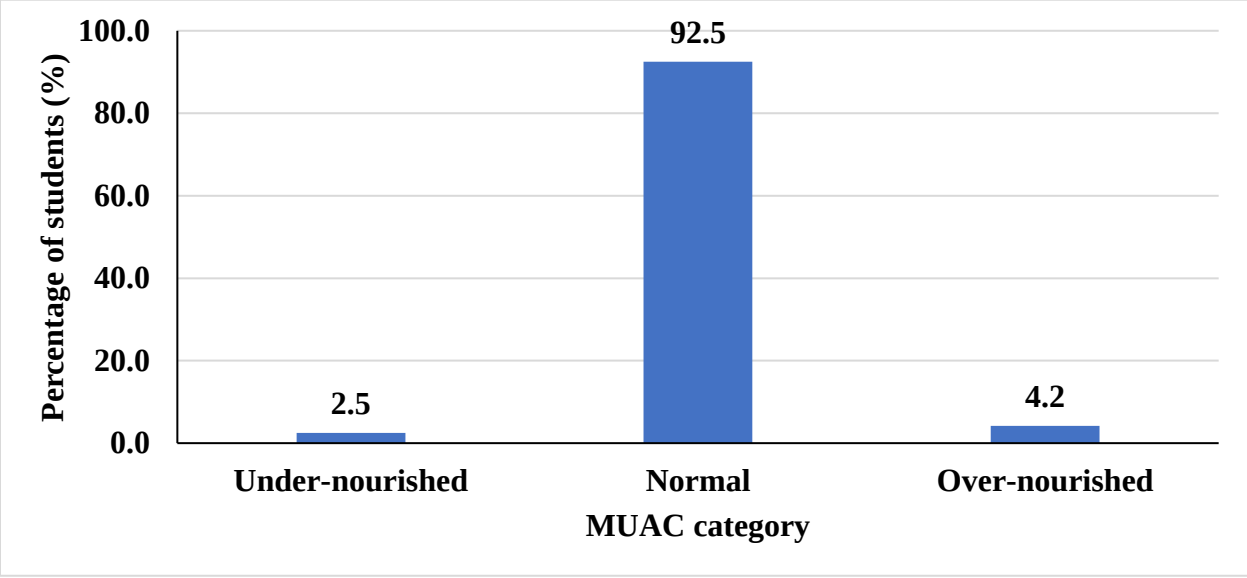

Figure 4-3 Students' MUAC category

4.3.3 Factors that influence nutrition status of students

Table 4.8 examined various socio-demographic, economic, behavioral, and dietary diversity predictors of students' nutritional status using both Body Mass Index (BMI) and Mid-Upper Arm Circumference (MUAC) as outcome variables. The constant terms in both models were highly significant ($p = 0.000$), indicating good model fit at the intercept. However, most predictors were not statistically significant, suggesting that these factors, taken individually while controlling for others, do not strongly predict BMI or MUAC among students in this sample.

Among the predictors, marital status showed a marginally significant association with MUAC (B = 2.089, $p = 0.094$), implying that married students may have slightly better upper-arm circumference values, possibly due to more stable lifestyles or shared resources. Similarly, obtaining food from the street was marginally significant for MUAC (B = 1.015, $p = 0.095$), suggesting that students who consume street food may have higher MUAC values, which could reflect more frequent or energy-dense food access. However, the implications of this require cautious interpretation due to possible food quality and hygiene concerns.

Other factors like sex**,** having dependents**,** source of upkeep**,** nutrition training**,** residence**,** monthly upkeep, and food decision autonomy, dietary diversity (DDS) and Food frequency score (FFS) were not statistically significant predictors of BMI or MUAC ($p > 0.10$ in all cases). For instance, although students self-sponsored for upkeep had lower BMI and MUAC coefficients, these relationships were not significant. Similarly, monthly upkeep**,** often expected to influence nutritional status, showed almost no effect on either BMI or MUAC.

Table 4-8 Factors that influence nutrition status of students

Factor	BMI		MUAC	
	B	**P-value**	**B**	**P-value**
DDS	0.164	0.291	0.075	0.540
FFS	-0.110	0.569	-0.042	0.774
Sex (Male)	0.797	0.238	0.496	0.329
Marital status (Married)	2.486	0.133	2.089	**0.094**
Having dependents	2.676	0.243	2.345	0.175
Provider of upkeep (Parents)	0.240	0.798	0.151	0.830
Provider of upkeep (Guardian)	0.583	0.454	0.258	0.659
Provider of upkeep (Private sponsor)	1.252	0.143	0.773	0.229
Provider of upkeep (Self)	-0.398	0.666	-0.040	0.954
Nutrition training	0.032	0.966	-0.293	0.598
Food source (Home)	0.786	0.296	0.373	0.509
Food source (Local market)	-1.332	0.370	-0.221	0.843
Food source (Supermarket)	-0.659	0.418	-0.020	0.974
Food source (Street)	0.788	0.327	1.015	**0.095**
Food source (Cafeteria)	-0.074	0.925	0.594	0.318
Students residence (Hostel)	-1.524	0.223	-1.394	0.139
Cost of food	-0.294	0.680	0.213	0.690
Monthly upkeep	0.072	0.940	0.089	0.902
Frequency of cooking own food	0.295	0.754	0.617	0.386
Decision on food eaten (Self)	0.279	0.770	0.475	0.508
Constant	20.110	**0.000**	23.445	**0.000**

4.4 Academic performance of students

4.4.1 Students' grade categories

Majority of students (48.3%) were in the Second-class Lower category, followed by 31.7% in the Second class Upper**.** A smaller proportion, 6.7%, attained a First Class, while 13.3% were in the Pass category (table 4-9).

Table 4-9 Students grade range and category/level

GPA Range	Grade level	Frequency (n=120)	Percentage (%)
(4.40 – 5.00)	First class	8	6.7
(3.60 – 4.39)	Second class upper	38	31.7
(3.00 – 3.59)	Second class low	58	48.3
(2.00 – 2.90)	Pass	16	13.3

4.4.2 Students' behavior and engagement in academic activities

Table 4-10, the majority of students (52.5%) reported studying for 1–2 hours outside class per day. A smaller proportion (28.3%) studied less than 1 hour, while only 4.2% studied for more than 4 hours, indicating that most students dedicate minimal time to personal study. Most students reported being often (39.2%) or sometimes alert (43.3%) during lectures. Only 13.3% claimed to be always alert, while a very small percentage (4.2%) were rarely alert, which may impact learning retention and participation. About 40.8% of the students reported attending class often (70–90%), and 35.0% attended always (above 90%). A significant portion (24.2%) had sometimes (50–69%) attendance, suggesting that one-fourth of the students had suboptimal class attendance. Half of the students (50.8%) described their class participation as moderate, 34.2% as rare, and only 15.0% considered themselves very active. This shows a general lack of strong engagement in interactive learning during class sessions.

Table 4-10 Students' engagement in academic activities

Variable	Category	Frequency (n=120)	Percentage (%)
Hours spent studying outside class	<1 hour	34	28.3
	1-2 hours	63	52.5
	3-4 hours	18	15.0
	>4 hours	5	4.2
Alertness during lecture	Always (> 90%)	16	13.3
	Often (70-90%)	47	39.2
	Sometimes (50-69%)	52	43.3
	Rarely (<50%)	5	4.2
Class attendance	Always (> 90%)	42	35.0
	Often (70-90%)	49	40.8
	Sometimes (50-69%)	29	24.2
Participation in class activities	Very active	18	15.0
	Moderate	61	50.8
	Rare	41	34.2

4.4.3 Factors that influence academic performance of students

The logistic regression model (binary) identified several key predictors of academic performance among Gulu University students. Dietary Diversity Score (DDS) had a significant positive effect (B = 0.471, p = 0.025), indicating that students with more diverse diets were more likely to attain good academic grades. Similarly, alertness during lectures (B = 1.125, p = 0.007) and activeness during class activities (B = 1.038, p = 0.023) were also strong, significant predictors, suggesting that students who remain attentive and actively participate in class tend to perform better

academically. Interestingly, students whose upkeep came from parents (B = 3.260, $p = 0.043$) or guardians (B = 3.172, $p = 0.048$) were significantly more likely to achieve higher grades compared to those supported by sponsors or self-funding. On the other hand, monthly upkeep showed a marginally significant negative association with grades (B = –0.874, $p = 0.094$), implying that students with higher financial support did not necessarily perform better, possibly due to lifestyle distractions. Other variables including food frequency score, sex, marital status, food source, nutrition training, and residence did not show statistically significant effects on academic performance ($p > 0.10$), although some, like cafeteria-sourced food and frequency of cooking, showed potential trends worth further exploration.

Table 4-11 Predictors of students' academic grades

Predictor	**Student's grade category**	
	B	**p-value**
DDS	0.471	**0.025**
FFS	0.079	0.623
Alertness during lectures	1.125	**0.007**
Frequency of attending lectures	-1.056	0.286
Activeness during class activities	1.038	**0.023**
Sex (Male)	-0.078	0.928
Marital status (Married)	2.452	0.216
Having dependents	-16.391	0.999
Provider of upkeep (Parents)	3.260	**0.043**
Provider of upkeep (Guardian)	3.172	**0.048**
Provider of upkeep (Sponsors)	0.891	0.578
Provider of upkeep (Self)	0.406	0.761
Training on nutrition	0.033	0.978
Food source (Home)	-1.552	0.158
Food source (Local market)	-20.038	0.999
Food source (Supermarket)	-2.360	0.130
Food source (Street)	-1.686	0.214
Food source (Cafeteria)	1.826	0.142
Students' residence (Hostel)	-19.701	0.999
Cost of food	-0.778	0.424
Monthly upkeep	–0.874	**0.094**
Frequency of cooking own food	-3.267	0.192
Constant	40.492	0.999

CHAPTER FIVE: DISCUSSION OF THE RESULTS

5.0 Introduction

This chapter explains the findings from the study; the results showed some connection between dietary diversity and other socio-demographic characteristics. Findings are explained in relations to previous studies.

5.1 Socio-demographic characteristics

The socio-demographic profile of students is crucial in shaping their dietary behavior, nutritional status, and academic outcomes. The near-equal gender distribution observed reflects typical enrollment trends in many universities across sub-Saharan Africa, where gender parity in higher education has improved over time (Ibeh, 2021). However, gender may still influence health and academic outcomes due to differences in food preferences, stress coping mechanisms, and health-seeking behaviors (Mbhenyane et al., 2017).

The predominance of unmarried students aligns with the expected age group of university attendees. Being single may reduce family obligations, thus allowing more focus on studies; however, it may also contribute to erratic eating habits and limited meal planning skills, especially among students living away from home (Akoto et al., 2023). The large proportion of students residing in hostels (alone or with roommates) has implications for food choices and nutrition. Previous studies have shown that students living in hostels often face limitations in food preparation facilities and time, which can lead to poor dietary diversity and reliance on fast or street food (Olatona et al., 2018). Students' academic level was also varied, with more advanced students represented in the sample. This distribution is important because students' year of study has been shown to influence health behaviors, including diet and academic engagement. As academic demands increase in senior years, students may experience more stress and less time for structured meals (Tesfaye et al., 2023), potentially affecting their nutritional status and academic focus.

Monthly upkeep emerged as a key socio-economic indicator. The financial disparities among students likely influenced their ability to access diverse and nutritious foods. Several studies report that low monthly income is significantly associated with poor dietary diversity and inadequate

nutrient intake among university students (Mahmud, 2024). Limited financial resources may constrain students to cheap, calorie-dense foods that are often nutrient-poor.

Most students were financially dependent on parents or guardians, while a minority were self-sponsored. Students relying on parental or guardian support may face restrictions in food choices based on the predictability and sufficiency of funds. On the other hand, self-sponsored students might experience more pressure to manage limited budgets between food, rent, and academic needs, potentially compromising their dietary quality (H et al., n.d.).

The fact that most students had no dependents suggests fewer economic burdens outside personal needs. This could allow better focus on academics, though the few who supported dependents may face higher emotional and financial strain, affecting both nutritional and academic outcomes. Students with dependents often have added responsibilities that may reduce their time for studying or preparing meals (Nu'man, 2023).

Finally, the age range, with a mean age of about 24 years, corresponds with findings from studies in Uganda and Nigeria, which classify this period as a transitional phase where students adopt lifelong health behaviors (Bukari et al., 2020). At this stage, autonomy in dietary decisions increases, but without adequate knowledge and resources, many students fall into unhealthy eating habits.

5.2 Dietary diversity of students

The study shows that while a majority of students had received some form of nutrition training and made their own food choices, their dietary behavior was still largely influenced by structural and economic barriers. The dominant role of food cost as a barrier to dietary diversity aligns with prior studies that found economic constraints to be the leading determinant of food choices among university students in low-income settings (Paulo et al., 2022). Although students often made independent decisions about what they ate, the limited financial capacity especially mid-to-late semester seemed to significantly reduce the variety of food consumed. This trend has also been reported in studies conducted among Ugandan and Ethiopian students, where early-semester food abundance typically declines due to financial exhaustion (Bitew et al., 2021).

The finding that nearly all students cook their own food may suggest a high level of autonomy, but also possibly reflects gaps in institutional food services. While self-cooking may support better food hygiene, it doesn't necessarily guarantee diversity, especially when combined with limited cooking skills or time (Wirt & Collins, 2009). Additionally, seasonal changes were reported to significantly influence food variety, supporting prior evidence that food access and affordability among students in agrarian economies fluctuate with harvest periods (Hasan et al., 2023).

The predominance of local markets and street vendors as food sources implies a strong reliance on informal food systems. These outlets are often cheaper and more accessible but may compromise nutritional value due to the heavy presence of energy-dense, low-nutrient foods (Senekal et al., 2020). Interestingly, supermarkets and cafeterias were less relied upon, possibly due to higher prices and limited food diversity offered in institutional settings, respectively.

Students demonstrated several coping strategies in response to food insecurity, notably resorting to cheap, less nutritious options, which is a widely recognized response in constrained environments (Miller et al., 2022). Skipping meals and consuming carbohydrate-rich foods reflect attempts to meet satiety with minimal resources, a pattern that risks micronutrient deficiencies (Opie et al., 2015). The social strategy of visiting friends or relatives mirrors coping mechanisms observed in other African university settings, where students leverage social capital to buffer food shortages (Oluoch, 2024).

The regression analysis identifies key socio-economic and demographic factors shaping food group consumption. Financial ability (monthly upkeep) significantly predicted vegetable intake, affirming that healthy foods like vegetables remain inaccessible for many low-income students (Rousham et al., 2020). Similarly, students with dependents were more likely to consume vegetables possibly due to increased responsibility and shared family-style meal practices.

Sex significantly influenced egg and meat consumption, with female students consuming more, which is consistent with studies that suggest women, particularly those with higher health awareness, tend to include more protein-rich foods in their diets (Siregar, 2022). Additionally, faculty of study and residence had marginal associations with fish consumption. Science students and hostel residents might have greater exposure to nutrition education or better access to cooking facilities, hence improving their food choices (Musaiger et al., 2016).

Notably, nutrition training and food decision autonomy had no significant influence across most food groups, possibly pointing to a gap between knowledge and actual practice, a disconnect often observed in university students globally (Kothe & Mullan, 2014).

The average Dietary Diversity Score (DDS) of 5.84 indicates moderate diversity, consistent with prior findings among university students in Eastern Africa (Asmelash et al., 2024). However, the wide range (1 to 11) and the standard deviation suggest disparities in access and choices among students. The Food Frequency Score (FFS) also shows high variability, reflecting inconsistency in regular food access or availability. According to FAO guidelines, scores below 6 often indicate inadequate dietary diversity and risk of micronutrient deficiencies (Nishida et al., 2004).

This variability may be linked to socioeconomic factors already discussed, but it also emphasizes the need for targeted interventions to promote consistent, diverse diets. Students with lower DDSs may benefit from structured institutional meal programs or subsidies that improve access to a variety of foods.

5.3 Nutritional status of Gulu university students

The overall nutritional profile of students, as assessed through anthropometric indicators (BMI and MUAC), reflects a relatively healthy population, with the majority falling within normal ranges. The average BMI of 22.45 kg/m² and MUAC of 27.05 cm suggest that, generally, students were neither undernourished nor overweight, which is consistent with what has been observed in other university populations in sub-Saharan Africa (Florence et al., 2008).

However, the presence of both undernutrition (6.7% underweight by BMI, 2.5% undernourished by MUAC) and overnutrition (20% above normal BMI, 4.2% elevated MUAC) points to a double burden of malnutrition within the student body. This dual challenge is well-documented in the literature, especially in transitioning populations where unhealthy eating patterns, stress, and sedentary lifestyles coexist with economic and food access barriers (De Oliveira Otto et al., 2015).

The high standard deviation in both weight and BMI indicates significant variability in nutritional status, which could reflect unequal access to nutritious food, differences in physical activity, or varying levels of nutrition knowledge and behavior.

The regression analysis showed that most individual predictors ranging from socio-demographic to behavioral and dietary factors did not have a statistically significant association with BMI or MUAC. This suggests that nutritional outcomes among students are influenced by a complex interplay of multiple factors, rather than by single variables acting independently. This aligns with prior findings from university settings in Kenya and Ghana, where predictors such as age, sex, or economic status were only weakly associated with nutritional outcomes unless examined in interaction with environmental or behavioral moderators (Bitew et al., 2021).

Among the variables with marginal significance, marital status showed a slight positive relationship with MUAC ($p = 0.094$), possibly because married students may benefit from shared meal preparation, financial pooling, or better structured daily routines. This is supported by evidence showing that marriage can provide social and economic stability that favors better nutrition (Akinlua O, 2014). Another borderline association was found with street food consumption and MUAC ($p = 0.095$). While this could imply that students consuming street food have more frequent access to energy-dense meals, it raises concern about the quality rather than quantity of such diets. Similar patterns have been observed among Nigerian and South African students, where increased reliance on street foods contributed to higher caloric intake but with low nutrient diversity and possible health risks (Abubakar et al., 2024).

Interestingly, factors that are commonly believed to influence nutritional status—such as monthly upkeep, source of food, residence type, and dietary diversity (DDS) did not show a significant effect in this sample. This may suggest that short-term income or autonomy in food decision-making does not necessarily translate into better nutrition outcomes, especially if constrained by broader institutional or food environment limitations. It also implies that nutrition knowledge and access must be supported by environmental enablers, such as student food programs or affordable campus markets, to have a tangible impact. Furthermore, the absence of association between DDS and BMI contradicts some studies that link low dietary diversity with undernutrition and micronutrient deficiencies (Asmelash et al., 2024). This might be due to the overall moderate DDS observed in the sample, or the fact that BMI and MUAC being crude indicators may not capture micronutrient inadequacies unless severe.

5.4 Academic performance of Gulu university students.

The distribution of academic grades among students reflects a performance skewed toward average achievement. This pattern is common among undergraduate populations where diverse challenges, including academic, economic, and psychosocial stressors, often hinder the attainment of excellent academic outcomes. Similar trends have been documented in studies conducted in other African universities, where socio-economic inequalities and limited academic support services constrain student performance (Garti et al., 2024; Id et al., 2021). It's also important to consider that academic performance is not only a function of intellectual capability but also of the learning environment, student engagement, nutrition, and psychological well-being. High academic expectations, poor time management, and limited access to quality study materials or conducive spaces for learning may further compound performance outcomes, particularly for students from underprivileged backgrounds (Liu et al., 2022).

Low levels of alertness, minimal time spent on self-study, and reduced activeness during class sessions may reflect broader systemic and personal challenges faced by students. These behaviors are known to correlate with weaker academic outcomes, as shown by (Asmelash et al., 2024), who found that attentiveness and time investment in personal study are among the strongest predictors of academic achievement. Moreover, reduced participation in classroom activities may imply passive learning styles, which inhibit critical thinking, problem-solving, and retention. According to De Oliveira Otto et al., (2015), interactive engagement during learning enhances conceptual understanding and long-term academic success. Therefore, the reported low activeness may serve as an early indicator of pedagogical or motivational gaps that deserve institutional attention.

Furthermore, variations in class attendance and participation suggest the presence of structural and personal barriers such as financial stress, poor health, or competing responsibilities that impact students' academic habits and, by extension, their performance (Article, 2023).The regression analysis revealed important behavioral and nutritional predictors of students' academic performance. Alertness during lectures and activeness in class were both significantly associated with higher grades. These findings reinforce the principle that academic success is closely tied to student engagement and cognitive involvement in learning environments (Id et al., 2021). Dietary diversity emerged as a significant positive predictor of academic achievement. This supports a growing body of evidence linking nutrition to cognitive performance and learning outcomes. For

instance, Wirt & Collins, (2009) demonstrated that diversified nutrient intake contributes to better memory function, improved concentration, and reduced mental fatigue, all of which are essential for academic success.

Interestingly, financial support (monthly upkeep) also significantly influenced academic performance, although this relationship may be multifaceted. While increased financial support can provide stability, access to educational materials, and better nutrition, it may also introduce distractions or promote complacency in some students. Musaiger et al., (2016) discuss how financial comfort can both enhance or hinder academic outcomes depending on personal discipline and support structures. Moreover, the source of upkeep (i.e., parents or guardians) was positively associated with academic grades, suggesting that not only the amount but also the source of financial support matters. This may be due to the emotional and motivational influence of parental support, which has been highlighted as a crucial component of student success in higher education (Senanayake et al., 2025).

On the contrary, factors like sex, marital status, age, residence, food source, or frequency of cooking had no significant impact on academic performance. This aligns with findings by Suchitra et al., (2021) who concluded that in university contexts, individual behaviors and environmental engagement often override demographic variables in determining academic outcomes.

5.5 Relationships between dietary diversity, nutrition status and academic performance

Dietary diversity emerged as a critical but nuanced factor in shaping both the nutritional and academic outcomes among university students. The results indicate that the Dietary Diversity Score (DDS) had a significant positive association with academic performance ($B = 0.471$, $p = 0.025$)**,** while its relationship with nutritional status (BMI and MUAC) was statistically insignificant**.** This suggests that while dietary diversity may not significantly influence anthropometric indicators like BMI or MUAC in the short term, it appears to play a more direct role in cognitive functions that support learning and academic success. Diverse diets typically enhance the intake of essential micronutrients such as iron, zinc, B-vitamins, and omega-3 fatty acids, all of which have been shown to improve memory, attention span, and overall mental performance (Akinlua O, 2014). These nutrients are also implicated in synaptic plasticity, neurogenesis, and the modulation of neurotransmitters functions vital to academic excellence.

The finding aligns with Onabanjo et al. (2021)**,** who found a strong relationship between DDS and academic achievement among Nigerian undergraduates, emphasizing that students who consume a wider variety of food groups tend to score higher GPAs. Similarly, (H et al., n.d.) in a Ugandan university context found that students with moderate to high DDS were more likely to report better concentration during lectures, improved test performance, and lower exam anxiety.

However, the absence of a significant relationship between DDS and nutritional status in this study warrants careful interpretation. Nutritional status indicators like BMI and MUAC are influenced by not only dietary quality but also total caloric intake, physical activity, and metabolic variations**.** A student may consume a diverse diet but still maintain average anthropometric measures if portion sizes are small or irregular due to food insecurity or other stressors. Furthermore, university students often have irregular eating schedules and high psychological stress, which can mask the expected impact of dietary diversity on body composition (Article, 2023).

Moreover, students in the current study faced barriers to dietary diversity, such as high food cost (60.8%)**,** seasonal food variation (78.3%)**,** and reduced food variety as the semester progresses (74.7%)**.** These disruptions can lead to periods of dietary monotony, especially toward the end of academic terms when resources are depleted. Such fluctuations may blunt the potential positive effects of DDS on long-term nutritional status, even if short-term cognitive benefits remain evident.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.0 Summary of Key Findings

This study assessed the effect of dietary diversity on the nutritional status and academic performance of Gulu University students. A total of 120 students from various faculties participated in the research. The findings revealed a nearly equal gender representation and a predominantly single student population. Most students resided in hostels, either alone or with roommates, and a significant proportion reported receiving modest monthly upkeep between 50,000 and 100,000 UGX, primarily from parents or sponsors.

In terms of dietary behavior, the majority of students (70.8%) had received some training in nutrition, yet food cost emerged as the leading barrier to dietary variety. A large percentage (99.2%) cooked their own food at least once per week, and most determined their own food choices. However, seasonal variations and semester progression affected their dietary variety, with many reporting higher food diversity at the beginning of the semester, which declined over time. The most common sources of food were local markets and street vendors, and during food shortages, many students resorted to coping strategies such as buying cheap, less nutritious food and skipping meals.

The dietary diversity score (DDS) had a mean of 5.84, indicating moderate diversity, while the food frequency score (FFS) averaged 9.61. Regression analysis showed that monthly upkeep and having dependents were positively associated with the consumption of certain food groups like fruits, while sex significantly predicted egg consumption. However, factors such as faculty, residence, and cooking frequency had limited influence on food group intake.

Regarding nutritional status, most students had normal BMI and MUAC values, with BMI averaging 22.45 and MUAC 27.05 cm. Year of study significantly predicted both BMI and MUAC, suggesting improved nutritional status with academic progression, possibly due to better adaptation and coping mechanisms over time. Food choice negatively affected MUAC, implying that poor meal selection patterns could compromise physical nutrition. In terms of academic performance, most students fell into the second-class lower and upper divisions, with very few attaining first-class grades. Students' engagement in academic activities varied, with most studying for only 1–2 hours a day and showing moderate participation in class. Interestingly, increased hours of study were positively correlated with grades, but alertness and attendance showed weak

negative relationships, suggesting that other factors like study habits or stress may mediate performance outcomes.

Finally, dietary diversity showed a significant positive effect on academic performance but did not significantly predict BMI or MUAC. A strong correlation existed between MUAC and BMI, and a moderate correlation was observed between DDS and FFS. Although MUAC showed a weak positive trend with academic performance, this was not statistically significant. These results underscore the importance of dietary quality in supporting cognitive functions, even when visible changes in body composition are minimal.

6.1 Conclusion

The study concludes that dietary diversity plays a significant role in influencing students' academic performance, highlighting the importance of access to varied and nutritious foods. While most students maintained normal nutritional status, their diet quality was moderately diverse and highly influenced by financial limitations, seasonal changes, and living conditions. Students with higher upkeep and those who prepared their own meals showed better dietary behaviors. Nutritional status indicators improved with academic year, possibly due to experience and adaptation, but they did not show a strong influence on academic performance. The weak relationship between MUAC, BMI, and grades suggests that cognitive outcomes are more sensitive to dietary quality than physical appearance or body metrics. Therefore, while adequate nutrition remains vital for general well-being, cognitive performance benefits more directly from micronutrient-rich and balanced diets.

6.2 Recommendations

Based on the findings, the following recommendations are made to improve dietary practices, nutritional status, and academic performance among university students:

University-led nutrition education programs should be intensified, focusing not only on basic knowledge but also on practical skills like budgeting for nutritious meals, seasonal food planning, and affordable dietary diversification strategies.

Subsidized healthy meal programs or meal vouchers should be introduced, especially targeting students with lower monthly upkeep or those living independently, to reduce reliance on cheap, carbohydrate-rich or low-nutrient foods.

The university should establish partnerships with local food vendors and suppliers to promote the availability and affordability of diverse, nutritious food options within and around the campus.

Student welfare offices should consider regular monitoring of dietary patterns and nutritional status, especially for first-year students who may face adjustment challenges. Simple screening tools like MUAC can be used during routine health checks.

Academic support programs should include time management and self-regulated learning training, considering that more study hours and better food diversity were linked with improved grades, despite weak classroom engagement.

Further research should be conducted with larger, longitudinal samples to explore the long-term effects of dietary diversity and nutritional status on academic performance, including psychological and emotional wellbeing variables.

In conclusion, nutrition and academic success are intertwined, and addressing students' dietary challenges through targeted interventions can enhance their academic potential while promoting better health and well-being across university communities.

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Appendices

Appendix I Questionnaire

EFFECT OF DIETARY DIVERSITY ON NUTRITIONAL STATUS AND ACADEMIC PERFORMANCE OF GULU UNIVERSITY STUDENTS

Dear respondent,

I am Adyera Simon Peter, a student of Gulu University pursuing Bachelor of Science in Food-bioscience and Agribusiness. I'm currently conducting a study on "The effect of Dietary Diversity on Nutritional status and Academic Performance of Gulu University students". The information being sough is entirely for academic purpose. Your participation is completely at will and will be highly impactful to this study. I request for your truthfulness for the successful completion of this research.

Thank you

Participant name (optional)…….

Section A: Socio-Demographics information

Instruction: tick in the box or the answer which applies to you

S/N	QUESTION	RESPONSES/OPTIONS	……CODE/YEARS
1	What is your age?		
2	What is your Sex?	a. Male b. Female	
3	Marital Status	a. Single b. Married c. Divorced d. Widowed	
4	What is your year of Study	a. 1st b. 2nd c. 3rd d. 4th or above	
5	Which Faculty of Study?	a) Law b) Business c) Science d) Medicine e) Agriculture f) Education Institute of peace	
6	What is your residents from school?	a. Home with parent b. With relative c. Hostel alone d. Hostel with roommate(s)	

7	Do you have dependents (children, spouse)?	a) Yes b) No	
8	If yes, how many children/ spouse(s) do you care for?		
9	How much money do you use for your monthly upkeep (UGX)?	a) <50,000 b) 50,000–100,000 c) 100,001–200,000 d) >200,000	
10	Who provides your upkeep?	a) Parents b) Guardian c) Self-sponsored. d) Other (specify): …..	

Section B: Dietary Diversity among Gulu University Students

11	Have you ever received any formal or informal education about healthy eating or nutrition?	a) Yes, formal (classroom or training) b) Yes, informal (workshops, social media, peers) c) No	
12	In your opinion, what is the biggest barrier to eating a variety of foods?	a) Cost of food b) Lack of time to prepare meals c) Limited availability of foods d) Lack of knowledge about food diversity e) Peer or cultural influence f) Other: _____	
13	Where do you usually get most of your food?	a) Campus cafeteria b) Local markets c) Supermarkets/shops d) Home (brought from family) e) Street food vendors f) Other: _____	
14	How often do you cook your own meals?	a) Daily b) A few times a week c) Rarely d) Never	
15	Who mainly decides what you eat?	a) Myself b) Roommate/friend c) Family d) Cafeteria/food provider	
16	Do you experience changes in the variety of food you eat across different months/semesters?	a) Yes b) No	
17	If yes, describe briefly how	…… …… ……	
18	Do seasonal variations affect the availability or price of food you eat regularly?	a) Yes b) No	

19	When facing limited food access, what do you usually do? (Tick all that apply)	a) Skip meals b) Borrow money or food c) Buy cheaper, less nutritious food d) Eat only carbohydrate-rich foods e) Visit family/friends for food	

Section C: Nutrition Status of Students

Body Conformation measures

S/N	Measurement	Value
1	Height (m)	
2	Weight (Kg)	
3	Mid Upper Arm Circumference (MUAC) (cm)	
4	Body Mass Index (BMI)	

Section D: academic performance of students

S/N	QUESTION	RESPONSE/OPTION	..CODE/YEAR
23	What was your Grade (4.40-5.0 = first class, 3.6-4.39 = second class upper, 3.0-3.5 = second class lower, 2.0-2.9 = pass, and <2.0 = fail) for the previous semester?	a) First class b) Second class upper c) Second class lower d) Pass e) fail	
24	On average, how many hours do you spend studying (outside class) each day?	Less than 1 hour 1–2 hours 3–4 hours More than 4 hours	
25	How often do you feel alert and focused during lectures?	a) Always b) Often c) Sometimes d) Rarely	
26	How often do you attend your lectures and tutorials?	a) Always (above 90%) b) Often (70–90%) c) Sometimes (50–70%) d) Rarely (below 50%)	
27	How actively do you participate in class activities (discussions, group work, asking questions)?	a) Very actively b) Moderately c) Rarely d) Not at all	

Section B.2. Dietary diversity score and Food consumption frequency

Instruction: Write 1 for yes or 0 for no whether you ate the food in the food group or not in the past 24 hours. In addition, indicate by ticking in the box, how often you ate these foods within the past month as below (1= ≥4 times a week, 2=<4 times a week, 3=1 time a month and 4=0 times a month)

S/N	Food Group	Example	1=yes/0=No	Frequency
1	Cereals	Corn/maize, rice, wheat, sorghum, millet or any other grains or foods made from these (e.g. Bread, noodles, porridge or other grain products) + insert local foods e.g. Ugali, nshima, porridge or pastes or other locally available grains		
2	Vitamin-rich vegetables and tubers	Pumpkin, carrots, squash, or sweet potatoes that are orange inside + other locally available vitamin-A-rich vegetables (e.g. Red sweet pepper)		
3	White tubers and roots	White potatoes, white yams, white cassava, or other foods made from roots		
4	Dark green leafy vegetables	Dark green/leafy vegetables, including wild ones + locally available vitamin-A-rich leaves such as amaranth, cassava leaves, kale, spinach etc.		
5	Other vegetables	Other vegetables (e.g. Tomato, onion, eggplant), including wild vegetables		
6	Vitamin a rich fruits	Ripe mangoes, cantaloupe, apricots (fresh or dried), ripe papaya, dried peaches + other locally available vitamin A-rich fruits		
7	Other fruits	Other fruits, including wild fruits		
8	Organ meat (iron rich)	Liver, kidney, heart or other organ meats or blood-based foods		
9	Flesh meats	Beef, pork, lamb, goat, rabbit, wild game, chicken, duck, or other birds		
10	Eggs	Chicken, duck, guinea hen or any other egg		
11	Fish	Fresh or dried fish or shellfish		
12	Legumes, nuts and seeds	Beans, peas, lentils, nuts, seeds or foods made from these		
13	Milk and milk products	Milk, cheese, yogurt or other milk products		
14	Oils and fats	Oil, fats or butter added to food or used for cooking		
15	Red palm products	Red palm oil, palm nut or palm nut pulp sauce		
16	Spices, condiments, beverages, Sweets	Spices (black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages OR local examples		

Thank you for your participation